

Claims

- [c1] 1. An electrochemical cell comprising:
- a first electrode;
 - a second electrode;
 - a membrane disposed between and in fluid communication with said first electrode and said second electrode;
 - a first cell separator plate opposing said first electrode and defining a first flow field there between, said first flow field proximate a first frame member; and
 - a second cell separator plate opposing said second electrode and defining a second flow field there between, said second flow field proximate a second frame member;
- wherein said first cell separator plate, said second cell separator plate, said first frame member, said second frame member, or a combination thereof comprising at least one of the foregoing, are at least partially coated with a layer comprising elemental carbon.
- [c2] 2. The electrochemical cell of Claim 1, further comprising:
- a pressure pad disposed proximate said second cell separator plate and retained by a pressure pad separator

plate, said pressure pad separator plate proximate said second flow field;

wherein said pressure pad, said pressure pad separator plate, or a combination thereof comprising at least one of the foregoing, are at least partially coated with a layer comprising elemental carbon.

[c3] 3.The electrochemical cell of Claim 2, further comprising:

at least one of a first flow field member and a second flow field member, said first flow field member disposed at said first flow field, said second flow field member disposed at said second flow field;

wherein said first flow field member, said second flow field member, or a combination thereof comprising at least one of the foregoing, are at least partially coated with a layer comprising elemental carbon.

[c4] 4.The electrochemical cell of Claim 1, wherein the layer comprising elemental carbon has an electrical resistivity of equal to or less than about 1000 ohm-cm.

[c5] 5.The electrochemical cell of Claim 4, wherein the layer comprising elemental carbon has an electrical resistivity of equal to or less than about 10 ohm-cm.

[c6] 6.The electrochemical cell of Claim 5, wherein the layer

comprising elemental carbon has an electrical resistivity of equal to or less than about 1 ohm-cm.

[c7] 7.A method of coating a surface of an electrochemical cell comprising:
preparing a coating composition comprising a liquid dispersion of elemental carbon, the liquid dispersion comprising elemental carbon particles, a dispersing medium and a dispersing agent; and
applying the liquid dispersion to a surface of the electrochemical cell to provide an elemental carbon layer thereon.

[c8] 8.The method of Claim 7, further comprising:
separating substantially all of the dispersing medium from the elemental carbon particles resulting in the deposition of the elemental carbon particles on the surface to which the liquid dispersion was applied.

[c9] 9.The method of Claim 7, wherein said applying comprises:
rinsing and cleaning the surface to be coated;
conditioning the surface;
exposing the surface to the liquid dispersion; and
fixing the liquid dispersion.

[c10] 10.The method of Claim 9, further comprising:

microetching a portion of the surface to remove the deposited carbon.

- [c11] 11.The method of Claim 9, wherein:
said conditioning comprises exposing the surface to a conditioning agent comprising a cationic material; and
said fixing comprises at least one of chemical fixing and physical fixing to remove excess carbon deposits from the surface.
- [c12] 12.The method of Claim 7, wherein:
said elemental carbon particles comprise fibrous elemental carbon, carbon nanotubes, fullerene, carbon black, graphite, or a combination thereof comprising at least one of the foregoing;
said dispersing medium comprises an organic or an aqueous dispersing medium; and
said dispersing agent comprises a non-water soluble or a water soluble dispersing agent, and a binding agent in an amount effective to bind at least a portion of the carbon particles to the surface.
- [c13] 13.The method of Claim 12, wherein said elemental carbon particles comprise carbon black and graphite.
- [c14] 14.The method of Claim 12, wherein:
said aqueous dispersing medium comprises a solvent

that is equal to or greater than about 1 wt% water, a water soluble composition, a low molecular weight alcohol, methanol, ethanol, isopropanol, dimethylsulfoxide, tetrahydrofuran, ethylene, propylene glycol, water, deionized water, or a combination thereof comprising at least one of the foregoing.

- [c15] 15.The method of Claim 12, wherein:
said binding agent is present in an amount of equal to or greater than about 5 wt% and equal to or less than about 50 wt %; and
said binding agent comprises a natural or synthetic polymer, a polymerizable monomer, a water soluble material, or water dispersible material.
- [c16] 16.The method of Claim 15, wherein said binding agent is selected from the group consisting of monosaccharides, polysaccharides, ionic polymers, and any combination thereof comprising at least one of the foregoing.
- [c17] 17.The method of Claim 15, wherein said binding agent further comprises an anionic dispersing agent, or a binding agent having an anionic character
- [c18] 18.The method of Claim 17, wherein said anionic dispersing agent comprises acrylic latices or aqueous solutions of alkali metal polyacrylates.

- [c19] 19.The method of Claim 17, wherein said anionic dispersing agent comprises a weight average molecular weight of equal to or less than about 1000 Daltons.
- [c20] 20.The method of Claim 7, wherein said coating composition has a pH of equal to or greater than about 3 and equal to or less than about 8.
- [c21] 21.The method of Claim 20, wherein said coating composition has a pH of equal to or greater than about 5 and equal to or less than about 7.5.
- [c22] 22.The method of Claim 21, wherein said coating composition has a pH of equal to or greater than about 6 and equal to or less than about 7.
- [c23] 23.The method of Claim 12, wherein:
said elemental carbon particles are present in an amount of equal to or greater than about 5 wt% and equal to or less than about 25 wt%.
- [c24] 24.The method of Claim 23, wherein:
said elemental carbon particles are present in an amount of equal to or greater than about 10 wt% and equal to or less than about 20 wt%.
- [c25] 25.The method of Claim 7, wherein:
said liquid dispersion further comprises at least one of a

pH buffer, a surfactant, and a chelating agent.

- [c26] 26.A surface of the electrochemical cell of Claim 1 prepared by a method comprising:
electroplating the surface of the electrochemical cell to provide an elemental carbon layer thereon, said elemental carbon layer having an electrical resistivity of equal to or less than about 1000 ohm-cm.
- [c27] 27.The method of Claim 9, further comprising:
drying the surface to provide an elemental carbon layer thereon; and
microetching a portion of the surface to remove the deposited carbon to facilitate connection of one surface to another.
- [c28] 28.The method of Claim 27, wherein:
said conditioning comprises exposing the surface to a conditioning agent comprising a cationic material; and
said fixing comprises at least one of chemical fixing and physical fixing.
- [c29] 29.The method of Claim 27, wherein said cleaning and conditioning comprises:
exposing the surface to a mixture comprising at least one of an alkaline aqueous solution and a dispersion of a surfactant, and a conditioning agent.

[c30] 30.The method of Claim 28, wherein said physical fixing comprises:

exposing the surface to an air flow having an air pressure of equal to or greater than about 2 N/cm² and equal to or less than about 20 N/cm².

[c31] 31.The method of Claim 30, wherein said physical fixing comprises:

exposing the surface to an air flow having an air pressure of equal to or less than about 3 N/cm².

[c32] 32.The method of Claim 30, wherein said air flow is heated.

[c33] 33.A surface of an electrochemical cell having an electrical resistivity of equal to or less than about 1000 ohm-cm prepared by the method of Claim 27.